HUMAN RESPONSE TO DISASTERS

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We first discuss psychological response and coping behavior in disaster situations. We confirm earlier findings that people have a tendency to interpret the signs of danger within their daily context and to underestimate the possibility of a disaster. It is suggested that the repetitive and consistent information would help to induce adaptive responses. The typical coping patterns found were: (1) information gathering behavior, (2) activities closely related to one's family, (3) preventive or protective behaviors, and (4) self protection by moving. We found the following six psychological determinants of coping behavior: (1) recognizing the seriousness of the situation, (2) knowing appropriate behavior for the situation faced, (3) expecting the projected coping response to be feasible, (4) perceiving the cost and reward of acting, (5) feeling of imminence of danger and, (6) the state of emotion of those involved.

In the last part of the article we examine evacuation behavior in particular, based on our surveys in four communities in Japan. The central factors which determine evacuation decisions were: (1) direct perception of threat, (2) exposure to the evacuation advice, (3) factors relating to family, (4) community preparedness, and (5) demographic characteristics. We distinguish three basic phases in the evacuation process, that is, the timing of evacuation, the choice of transportation, and the sheltering activity. Threat conditions, exposure to evacuation advice, and one's location were found to relate to the timing of evacuation. Most people evacuated by car. No consistent pattern was found in the choice of shelters.

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Introduction

In this paper, we will discuss, empirically and theoretically, psychological response and coping behavior in emergencies.

In the last several years, many empirical studies have been conducted by the research group in the Institute of Journalism and Communication Studies (IJCS) at the University of Tokyo. This group, including the authors, have studied human responses in such emergencies as earthquakes, floods, fires, typhoons, and various threat situations. Through these studies we found some consistent patterns in psychological response and coping behavior. Some of them correspond with earlier findings in western countries, but others seem unique to Japanese communities.

In the first section of the paper, after introducing a cognitive psychological explanation, we will present our findings on responses in emergencies, and discuss the pattern of coping behavior we found and its psychological determinants. In the last part of the article, we will examine evacuation behavior in particular, since this is one of the most important topics in contemporary studies of disaster.

Psychological Response and Coping Behavior in Emergencies

As a first step in the analysis of emergency coping behavior, we should distinguish two kinds of disaster, those that provide warning, and those that do not. Floods caused by typhoons or heavy rainfalls are usually preceded by warnings or some kind of anticipatory signs, whereas most earthquakes suddenly occur. In this section of the article, we would like to concentrate mainly on the former kind of disaster.

Psychological Response to the Unlikely

First of all, it can be generalized that human beings have a tendency to deal with every new information encountered in daily life as if it is always within the range of daily happenings, and are apt to interprete it as such, that is, in line with the daily context. For example, there was a large flood which killed some 300 persons in the summer of 1982 in Nagasaki. As the residents there had experienced very small inundations almost every summer, they interpreted the beginning of the flood as just another ordinary inundation. But since the flood waters rose more than two meters deep within 30 minutes, victims lost the time to evacuate to a safer place.

Though this tendency has been called "normalcy bias" (Fritz, 1961) and is well known in disaster research (Quarantelli, 1980), it is not a concept only applicable to human behavior in disasters. Rather, we claim, it is also applicable to every aspect of human life because it is deeply rooted in human nature. As we see it: (1) The tendency enables everyday life to be efficient and smooth (Ikeda, 1984). If we did not absorb to the normal, we would always be flooded or overloaded by huge amounts of information. (2) As cognitive psychologists have noted (Neisser, 1976; Rumelhart, 1977), human beings have positive feedback systems. So they have very strong predispositions to confirm every hypothesis they project resulting in perceiving things that they have expected, and collecting the kind of information that only confirms their expectation (Snyder and Gangestad, 1981; Tversky and Kahneman, 1980). In this line of reasoning, they will "see" only ordinary things when they expected to do so. (3) As a consequence, people are biased in underestimating the possibilities of an event as being abnormal or out of the ordinary; they deal with the kind of information that is not in line with their expectation as "noise" or they do not see anything at all. Given all the things noted above, most information in the context of daily life is interpreted as indicating the normal or the usual.

Therefore, how would individuals reach a judgment that something is wrong in their environment?

Earlier findings in the American disaster research tradition suggest that they would not interpret a situation as dangerous unless they obtain additional information about the original danger sign (Mileti and Beck, 1975; Perry et al., 1981; Quarantelli, 1980). Moreover, it is well known that Americans who reside in areas which should be evacuated will not evacuate without several additional information (Mileti and Beck, 1975; Quarantelli, 1980). This fits well with findings in Japan (Ikeda, 1982). So, it follows that a repetitive notice of danger is important to make people change their definition of a situation from ordinary to emergency.

As in the case of the "normalcy bias" this also has a psychological basis. Repetition or redundancy is closely tied to the reliance placed on the information provided, though this might be seen as wasteful from the point of view of providing information. From the study of cognitive strategies, it is known that individuals attach greater importance to highly redundant but consistent information than they do to the less redundant, i.e., with less information concerning consistency, but with objective informativeness (Greene, 1976; Major, 1980).

For the same reason, repetitive and consistent information

from different sources plays an important role in inducing people to believe in the dangerousness of a situation. Especially "seeing" that the danger is present has an additive belief-inducing effect to warning. Moreover, "seeing" has greater effect than very often just warnings. As an old proverb, both in English and in Japanese, says, "seeing is believing." For instance, those who had believed that Nagasaki was immune to major floods were forced to perceive a disaster was possible when they saw the water was rising very rapidly (Institute of Journalism and Communication Studies (IJCS), 1984).

The next question we want to address is how individuals respond to an emergency situation once they define it as serious or once they are engulfed by it.

First, there has to be an arousal increment (such as fear, tension, or excitement) due to the recognition of the seriousness of the situation. The increased arousal itself, in turn, is likely to generate internal cues such as a consciousness that "I am fearful." This requires heavy information processing capacity, so that narrowing of the perceptual field ensues (See e.g. Eysenck, 1982). For example, in the very early stage of the Three Mile Island nuclear reactor accident, the operators, owing to their tension and excitement, concentrated their attention only on some specific numberical meters, with the result that more important indicators or the meaning of these were "out of sight and mind," and the critical time necessary for restoration of normal operations was lost (Yanagida, 1983).

This kind of worsening response, however, does not automatically lead into so called "panic." Very frequently, those responsible for emergency operations believe that "In large disasters there will be panic" or "Once the residents receive a warning to evacuate, they will do so immediately" (IJCS, 1985a; Ikeda, 1982), though this is far from reality in both the United States (Dynes and Qurantelli, 1973; Wenger et al., 1975) and in Japan (Ikeda, 1982; IJCS, 1984; 1978).

If so, what kinds of behaviors are frequent or prominent in the responses to emergency situation? What are their determinants?

Coping Pattern During Disasters

Even in the worst of disasters, individuals make various coping responses. We would like to enumerate some of the typical responses, discuss their pattern, then proceed to analyze the psychological determinants of coping in general.

Typical Responses and Their Pattern: First of all, one of the most frequent responses is, as mentioned above, the one related to the redefinition of the situation, that is, information

gathering behavior concerning the change in one's environment. A check is made for the presence of real danger in the situation. To put it more concretely, there is surveillance behavior such as looking out of the window, or switching on TV to confirm a warning. In the case of the Miyakejima disaster, those who were informed of the onset of the eruption tended to watch for the phenomenon itself (44 percent of them did so), to become alert to the outdoor wireless loudspeakers specially designed for emergencies (32 percent), or to try to keep informed about the situation via interpersonal communication (nineteen percent) (IJCS, 1985c). Other frequent responses are activities closely related to one's family, that is, phone calls to or joining one's family. In order to cope with the hazardous situation, families usually try to be together (Form and Nosow, 1958; Moore et al., 1963). If one was not with his or her family when the disaster struck or was about to strike, he/she would go back to his/her home in a hurry to see if other members were safe. Or if it was impossible to do that, he/she would attempt to confirm the safety of other members by phone calls. This holds true in disasters with anticipatory signs such as floods as well as sudden onset disasters such as earthquakes. As a consequence of these activities, the heavy phone calling usually exceeds the capacity of the communication system. For instance, in the Nagasaki flood, the heavy phone load continued for four days during the disaster, making it necessary to regulate private calls so communication lines would be free for important public emergency use. This can be regarded as a kind of the convergence phenomena (Fritz and Mathewson, 1957).

In addition, those who have not been able to contact their family members are inclined to ask the local radio or TV stations to broadcast information concerning their safety or where they are so that other family members can contact them. The stations, in response to these requests, begin to send out this sort of information. This service in Japan had its origin in broadcasts just after a huge typhoon disaster in 1959 which resulted in more than 5,000 deaths. In the Nagasaki flood disaster too, the two local stations in the area broadcast more than 4,000 items of this kind of information.

There also tends to occur a traffic convergence of those returning to the area. Just after the Nihonkai-Chuubu earthquake in 1983 the main traffic roads within the affected area were congested by those returning to the area even though the time was a weekday noon. Also in the Miyakejima volcano eruption that started around half past three on a weekday afternoon, 85 percent of those who were away from home when they learned of the eruption went back to their home immediately (even

88 percent of those who were at sea returned soon) (IJCS, 1985c).

The other coping response we should mention is disaster prevention or protection behavior, including preparations for evacuation. In the midst of disaster, people try to cope with the hazard without leaving home if possible. They give various reasons such as "thought it more dangerous to evacuate than to stay," "not all the family members were together yet," or "fearful of looting" (Ikeda, 1982; IJCS, 1984). In order to reduce danger or keep the hazard away from their home, they are inclined to reaise the tatami-mats against flooding, to shut up all the windows tightly against poisonous gas, to turn off fires in earthquakes, etc. Those who make these reactions are very frequently aware of the danger in the situation, so they are also prone to prepare for evacuation "just in case."

The remaining coping response is self protection by moving. In earthquakes, this involves going to a safer place. In floods, evacuation is undertaken as a last resort (as concerns this, see the next section of this paper). Frequencies or sequences of these four types of responses vary from disaster to disaster, as well as on previous background experience. For example in earthquakes, those who have not been accustomed to this hazard, tend first to protect themselves, the handicapped, or children, then they proceed, if possible to take preventive measures such as turning off fires. The analysis of coping responses to the Nikonkai-Chuubu earthquake shows this (IJCS, 1985b). However, in an earthquake prone area like Urakawa where the residents had experienced seven earthquakes of greater intensity than five and innumerable ones of smaller intensity in the last 20 years, preventive measures were given higher priorities even in the bigger earthquakes (Intensity 6) (IJCS, 1982). This is because the Urakawans have an earthquake background or "disaster subculture" (Moore et al., 1963; Hanningan and Kueneman, 1978; Wenger and Weller, 1973) regarding earthquakes. On the other hand, in case of disasters with precursers, such as volcanic eruptions, the sequence is apt to start with information gathering, going to family-relating activities or preventive activities, and follow by evacuation (IJCS, 1985c). For example, in the Miyakejima eruption, most residents followed such a sequence.

Psychological Determinants of Coping: What are the determinants of these coping responses? We can specify six determinants of coping behavior in general under emergency conditions (Ikeda, 1984; 1985). Of course, the determinants might be somewhat different corresponding to the type of response, but here we will discuss the fairly common or universal determinants.

A recognition of the seriousness or abnormalty in the situation. Especially when there is an ambiguous situation such as a lack of perception of the threatening agent or the perceived uncertainty of the hazard's dangerousness, this redefinition of the situation as serious is very important. We can mention several supporting studies for this contention; studies on coping behavior in response to false alarms (Ikeda, 1983; Mack and Baker, 1961), one on evacuation behavior caused by a chemical fire accident (IJCS, 1981; Ikeda, 1982), and that on evacuation behavior due to the Three Mile Island nuclear accident (Perry, 1981). In a rigorous model testing study using loglinear analysis, a verification of this contention was found by one of the authors (Ikeda, 1985); in the analysis of an incident caused by a false alarm of an earthquake (for the detailed description of this incident, see Okabe and Mikami (1983)), he showed that the redefinition of the situation, i.e. the belief in the alarm, was one of the important and strongest determinants of the general coping scale consisting of information gathering, prevention activity, and evacuation preparation (Figure 1).

A knowledge of appropriate behavior in the situation. The effectiveness of warning is improved by providing information on how to cope with the situation (Ikeda, 1982; 1983; 1985). In the American disaster research tradition, the importance of this variable has been pointed out as very important in evacuation behavior (see the later section of this paper).

In addition, it is well known that those who have experienced many times the same type of disaster, know how to cope appropriately with the disaster agent. For example, the Urakawans with much earthquake experience had learned to put high priorities on preventive activities, and were able to perform them efficiently at the height of the disaster. In an analysis of the determinants of their preventive activities, it was found that their coping habit in past earthquakes was one of the most powerful determinants (Ikeda, 1985).

This reception to information or the coping habit mentioned above involves appropriate behavior for the emergency, and can be conceptualized as a behavioral script (Abelson, 1976; 1981). Therefore, it can be summarized that behavioral scripts appropriate to the situation are conducive to the execution of coping behavior.

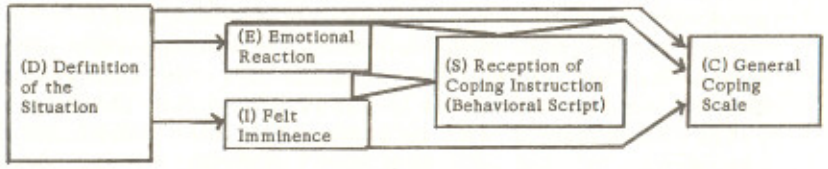
An expectation that the coping response is feasible. Believing that one can control the situation at hand motivates a person to confront and control it, or to put it another way, the belief plays a steering function for coping behavior. This contention has much in common with the notion of self-efficacy expectancy or self-fulfilling prophecy (Bandura, 1977; Bandura et al., 1980;

Fisher, 1984; Jones, 1977; Rotter, 1966). For instance, those who were involved in panic behavior were found to have a belief that they were not able to control the threatening agent such as fire itself, but they perceived that fleeing was a feasible way of coping with the situation (Quarantelli, 1954; 1957). This is to say that the direction of the coping behavior for the situation is steered by the perception of the control one has of the situation. In the analysis of coping in the Urakawa-oki earthquake mentioned above, we found that the variable of whether victims were confident of coping with earthquakes, interacted with the behavioral script and this had an effect on preventive activities (Ikeda, 1985).

Perception of cost and reward. The analysis of the Nagasaki flood disaster suggests that one of the important determinants of evacuation preparation was this variable (Ikeda, 1985). The perceived rewards were higher than the perceived costs.

A perception of imminence of danger. This is one of the important factors in panic behavior. If participants do not perceive the danger as imminent, they will not flee in panic. This findings was obtained in our analysis of the false alarm mentioned earlier (see Figure 1). Moreover, in studies of complex decision-making, this variable of imminence also seems to be important (Bronner, 1973; Janis, 1982a; 1982b; Jais and Mann, 1977).

The state of emotion.There is a generalization derived from the study of evacuation behavior that to feel fearful only does not motivate people enough to evacuate (Quarantelli, 1980). The same holds true for general coping activities (Ikeda, 1985). That is, the emotional response can have positive effect on the coping response only if it is associated with the knowledge



— indicates casual relationship
▷ indicates interaction
Best Fit Model by Log-Linear Analysis DC, DE, DI, IC, SEC, SIE. ^{2} = 17,35; p= .9222.

Figure 1: Determinants of Coping Behavior With a False Earthquake Warning.

of appropriate response (Figure 1), but this is difficult in a sudden emergency such as an earthquake. Recent studies on fear communication are consistent with these findings (Leventhal, 1970; Rogers, 1975; Sutton, 1982).

The six factors mentioned above can be thought of as the psychological determinants of coping behavior.

Empirical Studies of Evacuation Behavior in Disasters

As discussed in the previous section, there are many kinds of coping behavior in response to warnings or other signs of danger, these ranging from information seeking to panicky flight. Evacuation is one of the last means taken to protect one's life. It is still one of the most effective and the least expensive countermeasures available, although in the last decades we have developed many technologies to prevent or mitigate damage from disasters.

In this section, we will first outline some of the major instances of recent mass evacuations in Japan which we studied using survey research methods. Then we will examine the process and determinants of evacuation behavior.

An Outline of Evacuations in Four Communities

Warehouse fire in Ohbu: About noon on October 1, 1980, a fire broke out at a very large warehouse in Ohbu city, Aichi Prefecture. About three hours after the fire started, the mayor advised about 4,000 ressidents within 500 meters leeward from the burning warehouse to evacuate, because there was a danger that some toxic gas might be generated by the fire. The advice to evacuate was transmitted through loudspeakers on public information cars and by the communication networks of community associations. At six o'clock in the evening, the evacuation advice was changed to an "order," and those warned by nine o'clock numbered more than 8,000 inhabitants. Although the fire continued 19 hours no toxic gas was ever detected and no person was killed.

The IJCS obtained a sample of the population through a telephone survey of 1,134 housewives in the designated evacuation area. The response rate was 63 percent. According to the survey, 32 percent of the population actually evacuated (IJCS, 1981; Ikeda, 1982).

Heavy rainfall and flood in Nagasaki. On the night of July 23, 1982, a heavy rainfall caused landslides and flooding in the vicinity of Nagasaki Prefecture. It killed 265 persons in the Prefecture. Although a warning of heavy rainfall and flood

was issued at 4:55 in the afternoon by the local meteorological observatory, most citizens and officials did not take the warning seriously and took little precaution. At about seven o'clock, the rainfall increased substantially and continued for several hours. It was as late as nine o'clock after major flooding had already occurred, when the city office using a public information car advised the residents along the Nakajima river to evacuate to higher ground.

IJCS conducted an interview survey of 1,000 adult residents along the Nakajima river in the Nagasaki city. The response rate was 44 percent. The result showed that only thirteen percent of the sample evacuated that night (IJCS, 1983; 1984).

Volcanic eruption on Miyakejima Island. At about 3:20 p.m. on October 3, 1983, the volcano on Miyakejima island suddenly erupted after twenty-one years of silence. A great flow of lava produced by the eruption buried the village of Ako, which is located at the southwest part of the island. About 340 out of 530 houses in the village were destroyed within several hours after the eruption. The eruption also produced a great deal of ashfall and caused much damage to the plants and crops at the village of Tsubota, which is located at the east side of the island. Fortunately there were no dead or injured persons as a result of the eruption. The municipal office of Miyakejima advised the residents of Ako to evacuate at 3:40 p.m. The advice was disseminated through a public address system. Furthermore, before four o'clock, the office sent eleven large buses to the village of Ako to evacuate the residents. Most of the residents in Ako evacuated to the village of Izu, which was thought to be the safest place in the island. The evacuation advice was issued only for Ako, but many residents in Tsubota evacuated voluntarily to nearby schools and other public shelters.

IJCS conducted an interview survey of all the 800 adult residents at Ako, and random sampled 300 adult residents at Tsubota. The response rates were 75 percent in Ako and 84 percent in Tsubota. The result of the survey indicates that 95 percent of the residents in Ako and 78 percent in Tsubota evacuated after the eruption (Mikami, 1984; IJCS, 1985).

Naganoken-seibu Earthquake. At about 8:48 a.m. on September 14, 1984, an earthquake of magnitude 6 occurred at the village of Otaki in Nagano Prefecture. It generated a large-scale landslide near the top of Mt. Ontake, a volcano about 2,900 meters high. A massive earthslide came down the valley and buried houses and rivers in the way. As a result, a natural lake was eventually formed at the upper Otaki river.

The village office issued an evacuation advisory to all the residents at about 9:30 a.m. It was given directly by village

officials as well as disseminated from the loudspeakers on a fire truck. The results of an IJCS of about 400 randomly selected residents (with a response rate of 63 percent) showed that 71 percent of the people evacuated that day (The Fire Defense Agency, 1985; IJCS, 1985d).

Evacuating and Not Evacuating

The evacuation rates in the above instances range from 13 to 96 percent, and seem to show no regularity. Therefore, the question is what factors are related to the decision to evacuate or not to evacuate. According to our studies of these evacuations, the central factors which are most closely related to decisions to evacuate are: (1) direct perception of threat, (2) exposure to evacuation advice, (3) factors relating to family, (4) community preparedness, and (5) occupational role, and (6) demographic characteristics.

Perception of Direct Threat: The existing literature on warning response indicates that the direct perception of the environmental threat is one of the most important factors in the decision to evacuate. For example, Perry et al. (1981) found that the most important reason for evacuating in the instances of flood in three communities in the United States was the "visible high water." We obtained similar findings in our surveys. In Ohbu, the most frequently given reason for evacuating was "the perception of smell or smoke" (54 percent). In Nagasaki, the major reason for evacuating was that "the level of water became higher," and that "the life of themselves and their family became dangerous." In Miyakejima, one of the most important reasons for evacuating was that "they felt danger because the ash and debris began to fall;" in Tsubota that "they felt imminent threat because they saw the eruption with their own eyes" (Table 1). The exceptions were found in Ako and Otaki, where the exposure to the warning message was the most frequently given reason for evacuating. It could be concluded that in most instances the direct perception of visible signs of threat was one of the most critical factors for evacuating.

The perception of danger was found to be significantly related to the distance from the center of the disaster agent in Ohbu. Thus, 73 percent of those who lived within 500 meters of the burning warehouse reported that the perception of danger was the most important reason for evacuating. Only 49 percent of those who lived outside of the 500 meters said they evacuated because they perceived danger directly (χ^2; $p<.01$).

On the other hand, when the perception of imminent threat is absent, evacuation behavior is not likely to occur. For example, Perry et al. (1981) found that the most important reason for

staying was related to "the belief that no real danger existed." We also found a similar tendency in our study. In Nagasaki, as much as 87 percent of the citizens did not evacuate. We asked them why they did not evacuate. The most frequent answer was that "they thought their house was not in danger." These tendencies to deny the existence of danger is known as "normalcy bias" (Fritz, 1961), as we had discussed earlier.

Exposure to Evacuation Advice: It is known that exposure to warning messages plays an important role in facilitating evacuation. In Nagasaki, Tsubota, and Otaki, the evacuation rates were significantly higher for those who heard the evacuation advice than those who did not (Table 2). In Ohbu, it was found that those who heard the warning from a neighborhood association, serving as an official communication channel in Japan, were more likely to evacuate than those who did not, while those who heard the warning from loudspeakers on the cars of city officials or police stations were less likely to evacuate than those who did not.

Further evidence is found in the question concerning the reasons for evacuating. The percentage of those who said that exposure to the evacuation advice by authorities was the most important reason was 30 percent in Ohbu, twelve in Nagasaki, twenty in Tsubota, 42 in Ako, and 44 in Ohtaki.

An awareness that the evacuation advice implies a threat

Table 1: Reasons for evacuating. Percent.

Reasons	Ohbu	Nagaski	Miyakejima	
			Ako	Tsubota
Perceived the danger	54	60	34	27
Heard the evacuation advice	30	12	42	20
Adviced by neighbors	--	--	11	16
Consulted with family and neighbors	20	19	--	--
Neighbors began to evacuate	7	12	5	13
Judged from past experience	--	--	3	6
Heard news on tv or radio	19	--	0	--
Other	12	3	5	14
Total	M.A.	M.A.	100	100
	227	58	579	196

also influenced a decision to evacuate (Table 3). In Ohbu, we found that the more respondents felt danger at the fire, the more they were likely to evacuate (χ^2; $p<.01$). This finding suggests that it is important not only for warning messages to reach residents, but the messages must also make the recipients aware of a danger to themselves.

Factors relating to Family and Neighbors: Evacuation decision-making is a social process, in which various social interactions and personal influences operate (Mikami, 1982). It is known that in almost all instances that the family is the fundamental unit in evacuation behavior. Past disaster-related literature indicates that people tend to evacuate with their family members (Drabek and Stephenson, 1971; Moore et al., 1963; Williams, 1964; IJCS, 1981). Our study in three communities confirms this finding. For example, 93 percent evacuated with their family members in Ohbu, and 79 evacuated with their family in Nagasaki (Table 4).

Whether people will evacuate with their family or not depends partly on the presence of infants or old persons who need the help of others. We found in all three communities that those who had infants less than four years old, or who had elderly persons more than seventy years old in their family, were more likely to evacuate than those who did not (Table 5).

Sex difference is also related to evacuating with family members. Although the relationship is not statistically significant because of our small sample size in Nagasaki and Tsubota, the tendency was for women more than for men to evacuate with their family. This may be partly explained by our findings in

Table 2: Evacuation Behavior by Exposure to Evacuation Advice. Percent.

Heard the Advice	Evacuated		
	Ohbu	Nagasaki	Tsubota
Yes	38	27	80
No	21	12	76
Total	32	13	78
N	711	443	251
χ^2	$p<.01$	$p<.05$	n.s.

field studies that some family members (usually males) tended to remain behind at home to protect their home after other family members had evacuated.

In addition to the family factor, it was found that the neighbors also played a substantial role in the evacuation behaviors. About 50 percent in Ako and 29 in Tsubota evacuated with neighbors (Table 4). Also twenty percent in Ohbu and nineteen in Nagasaki said that they evacuated as a result of discussions with neighbors and family. Also five percent i Ako, seven in Ohbu, twelve in Nagasaki, and thirteen in Tsubota indicated that they evacuated because their neighbors began to evacuate.

Community Preparedness: Past disaster experience has been often referred to as an important contributing factor in successful evacuation. As Quarantelli (1980) has stated: "repetitive threats encourage emergency agencies to develop preparedness measures that will organize the flight from danger." This factor was found to be quite important in Miyakejima Island. Miyakejima has a long history of volcanic eruption. The volcano has erupted at intervals of 20 to 60 years. The most recent eruptions occurred in 1940 and 1962. The local disaster office at Miyakejima had an emergency operational plan for volcanic eruptions, and had held an evacuation drill just a month before the last eruption. It also had installed a wireless public address system in all the villages to inform the public about emergencies. These preparedness measures contribute much to the organized evacuation after the eruption in October, 1983 (IJCS, 1984). As described in the emergency plan, buses were sent to the affected villages to help in the evacuation, and the public address system functioned well in disseminating a warning message to the residents and emergency organizations in the affected communities.

Table 3: Evacuation Behavior by the Risk Perception at the Time of the Evacuation Advice. Percent.

Perception of Risk	Evacuated		Total	N
	Yes	No		
Felt Severe Risk	63	38	101	128
Felt Moderate Risk	45	55	100	112
Felt Slight Risk	17	83	100	186

$p<.01$.

Table 4: Company During Evacuation. Percent.[a]

	Ohbu	Nagasaki	Miyakejima	
			Ako	Tsubota
With family members	93	79	77	69
With neighbors	12	5	51	29
Alone	1	16	5	11
N	227	58	579	196

a Multiple answers allowed.

Table 5: Percentage Evacuating With Family Members by the Presence of Elderly and Infants in the Family and by Sex.

	Ohbu	Nagasaki	Miyakejima	
			Ako	Tsubota
Elderly and Infants				
Present	95	92	85	86
Not Present	85	69	72	54
χ^2	$p<.01$	$p<.05$	$p<.01$	$p<.01$
Sex				
Men	--	71	72	61
Women	--	85	81	77
χ^2		n.s.	$p<.05$	n.s.
N	227	58	341	101

However, it is interesting to note that we found no significant relationship between individual experience of evacuating or participating in evacuation drills in the past, and a decision, to evacuate in the disaster. For example, in Miyakejima there were no significant difference in the evacuation rate between those who evacuated in the eruption of 1940 or 1962 and those who did not, or between those who participated in the evacuation drill in August 1983 and those who did not. In Nagasaki, too, individual experience of earlier residential flooding was not statistically correlated with evacuation behavior in the disaster.

Demographic and Geographic Factors: In our studies, sex and age were found to be related to evacuation decisions in some communities, although the tendencies were not always consistent. Women were more likely to evacuate than men in Tsubota and Otaki, while no significant sex difference was found in other communities. The relationship between age and evacuating was found to be significant in Ohbu and Otaki, although the direction of the association was opposite in the two cases. In Ohbu, the evacuation rate tended to decrease with age (χ^2; $p<.01$), while in Otaki the evacuation rate tended to increase with age (χ^2; $p<.01$). However, no significant age differences were found in other communities.

A common tendency was found for occupation in Tsubota and Otaki. In both communities, many of the local community officials, firefighters, police officers, and other officials engaged in disaster prevention activities. As a result, those respondents whose occupation was related to disaster counter-measures were less likely to evacuate than those who were not (χ^2; $p<.01$).

Process of Evacuation

In order to examine evacuation behavior in detail, we must take into account three basic phases in the evacuation process: (1) the timing of evacuation, (2) the choice of transportation for evacuating, and (3) the sheltering behavior. As for the time of evacuation, there is a tendency that the earlier the advice to evacuate is given, the earlier the evacuation occurs. The means of transportation for evacuation varies from taking buses or cars to walking, but most people use a car. Where and how long people will evacuate depends on various factors, and we did not find consistent tendencies.

Timing of Evacuation: Our research indicates that the following factors are related to the timing of evacuation: a) threat conditions, b) the timing of exposure to evacuation advice, c) the geographic circumstances of individuals, and d) past experiences of disasters.

Threat condition. According to the result of our surveys,

early evacuation can be attributed to an acute perception of the disaster threat and the quick onset of the disaster. In Ohbu, the fire broke out at 12:10, the danger was recognized at about three o'clock, and the evacuation advice was issued at 3:40 p.m. However, it was as late as 6:00 p.m. before city officials recognized the seriousness of the danger and switched from advice to an evacuation order. Furthermore, it was difficult to see directly whether any toxic gas was actually generated or not by the fire. As a result, most people evacuated more than four hours after the fire broke out.

In Nagasaki, at about seven o'clock in the evening a heavy rainfall suddenly hit the city and caused landslides and floods in a few hours. About 50 percent of those who perceived the danger, quickly evacuated by eight o'clock in the evening. In Miyakejima, more than 80 percent of the residents in Ako and Tsubota knew about the eruption in less than ten minutes. Moreover, the treat caused by the eruption was visible to them. As a result, a majority of the residents in Ako and Tsubota evacuated in an hour. Our survey in Ako also showed that an acute feeling of anxiety in watching the eruption facilitated early evacuation (Table 6).

Timing of exposure to evacuation advice. From our surveys, we observed a tendency for the earlier citizens who heard advice about evacuation, the earlier they evacuate. In Ohbu, for example, those who heard the advice before 9:44 p.m. evacuated earlier than those who heard it after 9:45. In Miyakejima, the evacuation advice by authority was given ten minutes after the eruption occurred, and was disseminated quickly through the wireless public address system to residents. As a result, the evacuation was carried out very quickly.

Geographic factors. The timing of evacuation is influenced

Table 6: Evacuation Time by the Degree of Anxiety at the Eruption (Ako). Percent.

Degree of Anxiety	Evacuated		Total	N
	Early	Late		
Severe	57	43	100	188
Moderate	39	61	100	188
Slight	40	60	100	172

$p<.01$.

by the place a person is located at when the threat is perceived. If a person is not at home upon receiving a warning and if the person thinks there will be some time before the disaster agent hits the area, the person may first return home and only then prepare to evacuate. Therefore, it is to be expected that the timing of evacuation by those who are not at home will be delayed if the onset of the disaster agent is relatively slow. This was confirmed in our study in Miyakejima. In both Ako and Tsubota, those who were at home when the eruption occurred were more likely to evacuate earlier than those who were not at home (Table 7).

Past experiences of disasters. It is known that in communities which have experience repeated disasters, collective evacuation is likely to take place relatively quickly. At the individual level, too, it is expected that those who have experienced disasters in the past will tend to evacuate more quickly than those who have not. Our survey results in Otaki supports this hypthesis (χ^2; $p<.01$), although no significant relationship was found in other communities.

Transportation for Evacuation: According to the literature on evacuation studies, people tend to use their own cars as a means of evacuation (Perry et al., 1981; Quarantelli, 1981). In Japan, the public transportation system has been highly developed, and most people use the system in their daily life. Also most evacuation plans of Japanese communities generally recommended that the residents of threatened areas should walk or use some official transportation to go to public shelters. In spite of these particular conditions in Japan, the results of our surveys on actual evacuation indicate that in most cases

Table 7: Percentage of Early Evacuation by People's Location at the Time of the Eruption (Miyakejima). Percent.

Location	Ako		Tsubota	
	Percent	N	Percent	N
At Home	59	236	59	76
In the Village	40	265	33	101
In Other Village	27	48	47	30
On the Sea	13	30	50	4
χ^2		$p<.01$		$p<.01$

people prefer to use their own or the cars of their neighbors for evacuating. Most people evacuated by cars in Ohbu and Miyakejima.

Although most people use cars for evacuating, it is important to note that many people used some other means of transportation in Ako, Tsubota, and Otaki. In Ako, 26 percent went to the public shelter on the official buses sent by the municipal office. Another fourteen percent used boats as a means of evacuation. In Tsubota and Otaki, about 45 and 58 percent, respectively, walked to the shelters instead of using cars. A factor in Tsubota and Otaki was that the public shelters were within walking distance, which may be one of the reasons why many people evacuated on foot.

The factors which were found to significantly correlate with the choice of transportation for evacuating in Ako were, a) participation in the evacuation drill, and b) whereabouts at the time of the volcanic eruption.

Participation in the evacuation drill. In Miyakejima, an evacuation drill was carried out about two months before the volcanic eruption. The purpose of the drill was to train the staffs of emergency agencies and to assure the residents that an effective evacuation out of the island was possible in case of a future volcanic eruption. Buses and boats were used in the drill. According to our survey, about 50 percent of the residents in Ako participated in the drill, and those who attended the drill were more likely to use buses (29 percent) or boats (eighteen percent) at the time of the disaster than those who did not (χ^2; $p<.01$). This tendency suggests the effectiveness of the drill in the choice of transportation in the actual evacuation.

Whereabouts at the eruption. In Ako we found some relationship between the location of the people at the time of the eruption and the transportation they used for evacuation. Those who were at home were more likely to use buses than those who were out, while those who were in other villages were more likely to evacuate by car than those who were in Ako (χ^2; $p<.01$).

The Problem of Sheltering: Choosing the shelters. According to the literature, people tend to evacuate to the houses of their relatives or friends instead of public shelters (Drabek and Boggs, 1968; Flynn, 1979; Quarantelli, 1980; Perry et al., 1981). However, this is not always the case in Japan. The only case which corresponds to the findings in western countries was at Ohbu, where 60 percent evacuated to the house of their relatives or friends. In Miyakejima, about 83 percent evacuated to public shelters, such as schools or other public buildings. In Nagasaki, the rainfall was so hard that most people could

not reach the public shelters or the houses of their friends, and were obliged to stay home or to take shelters at nearby buildings or on higher ground.

The choice of shelters are related to the content of the evacuation advice. In Ohbu, those who heard the advice which made reference to the public shelters were more likely to evacuate to the shelters than those who did not hear the advice. In Miyakejima, the village official advised the residents of Ako to evacuate to the neighboring village, and the volunteer fire-fighters in Ako and Tsubota advised the residents to evacuate to the public shelters. These advices may have contributed to the high percentages of public sheltering in Miyakejima.

Duration of sheltering. The last question to ask is how long people will stay at shelters after they have evacuated. The length of staying at shelters is largely determined by the duration of the disaster threat, the degree of damage to residences, the cancellation of the evacuation advice, and the condition of life in shelters.

In Ohbu, the fire was extinguished and the danger was over by six o'clock the next morning. The official advice to evacuate was cancelled at 6:30. The fire did little damage beyond the warehouse, and residents were not touched by the fire at all. As a result, about 55 percent of the evacuees returned home by six o'clock the next morning. In Nagasaki, the flood waters had receeded and the danger of flood was over by the next morning. Although many houses along the Nakajima river were damaged by the flooding, most of them had a second floor which was undamaged. As a result, most citizens left the shelters within twelve hours after they evacuated to them. On the other hand, many residents in Ako were obliged to live in public shelters for a long period, because they lost their houses in the lavas caused by the eruption. Most of the evacuees in Tsubota returned home by the next day because their houses were not seriously harmed by the eruption, and the advice to evacuate was never given to the residents of Tsubota. In Otaki, the evacuation advice continued in effect until October 25. During this period, many residents, especially those who had been living along the upper Otaki river, were obliged to stay at the public shelters because of the lack of transportation.

Concluding Remarks

In this paper, based on our survey data from several Japanese communities we discussed psychological and behavioral responses in emergencies and examined evacuation behavior. We would like to conclude with a few policy implications of our study for disaster prevention planning and other countermeasures.

In our discussion we stressed the importance of the information which helps to define accurately the threat of disaster. In order to induce such adaptive response from individuals, it is necessary for emergency agencies to provide reliable and consistent information repeatedly from various sources on the nature of the emergency threat.

The second overall finding in our study was the tendency of people in disasters to get together with their family members, as well as confirming the safety of other members, protecting other members, and evacuating with other family members. Therefore, family or household units must be treated as basic units in making effective and realistic planning for evacuation and other disaster countermeasures.

As for the problems of evacuation, we found that advice to evacuate was important as a factor in inducing evacuation behavior. We suggest that warning or evacuation advice should be issued as early as possible from reliable sources, and that the message should arouse awareness of threat in the recipients. Wireless public address systems can be recommended as an effective means for disseminating warnings to the public and for facilitating evacuation decisions, as was proven in Miyakejima.

The last thing to note is that we found many similarities as well as some differences in the responses of people to warnings in Japanese communities threatened by various kinds of disasters. Most of the findings did support the conclusions obtained from studies in western societies. However, there were enough differences to lead us to suggest it would be fruitful that comparative disaster studies, using common measures, be undertaken on the response of people to different disaster agents in different cultures.

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